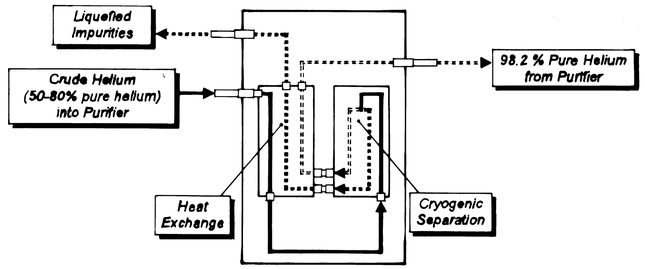
PURIFICATION PROCESS

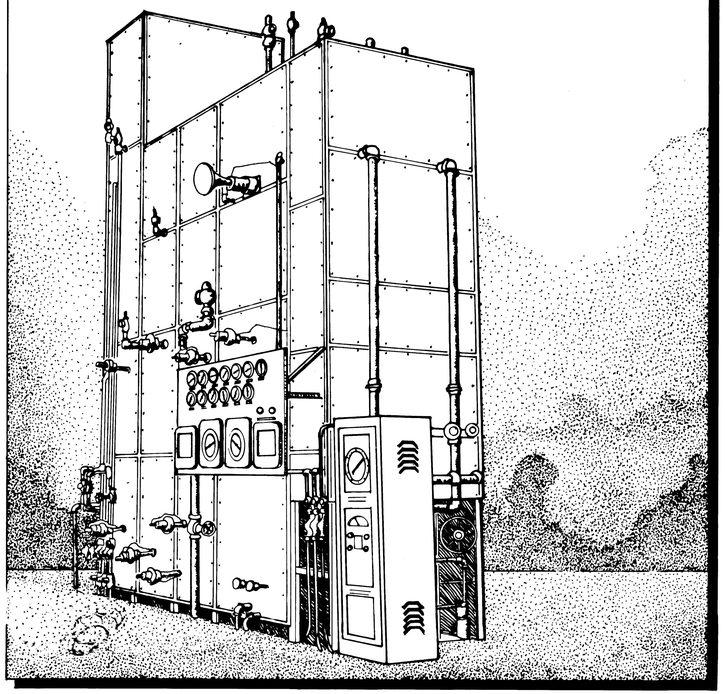
Exell Helium Plant

98.2 Percent Pure Helium — 1943-1945

Initially, Exell employed the same process and equipment that was in use at Amarillo. Not much had changed since the Bureau of Mines' production methods at Ft. Worth. The basic process involved CO_2 extraction, followed by cryogenic separation into crude helium, and further cryogenic purification.

The key technological components of the early cryogenic process were heat exchangers. Using varying pressures, the heat exchangers supercooled the incoming natural gas to liquefy all other gases (methane, hydrogen, and nitrogen) except the helium, which liquefies at -452° Fahrenheit, or nearly absolute zero. Plant operators stored the liquefied nitrogen in tanks for reuse to supercool incoming gas. This process produced 98.2 percent helium purity, which was sufficient to meet the needs of the military and other federal agencies during World War II.

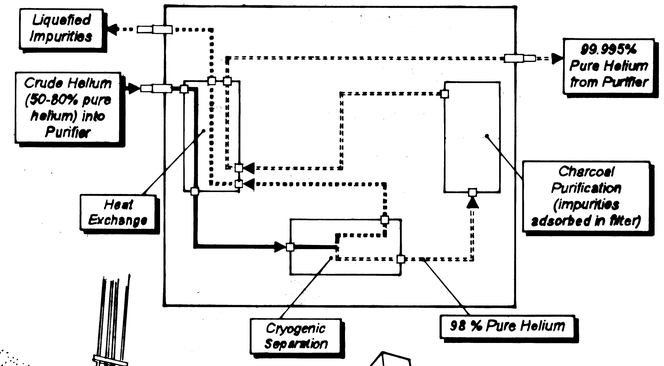


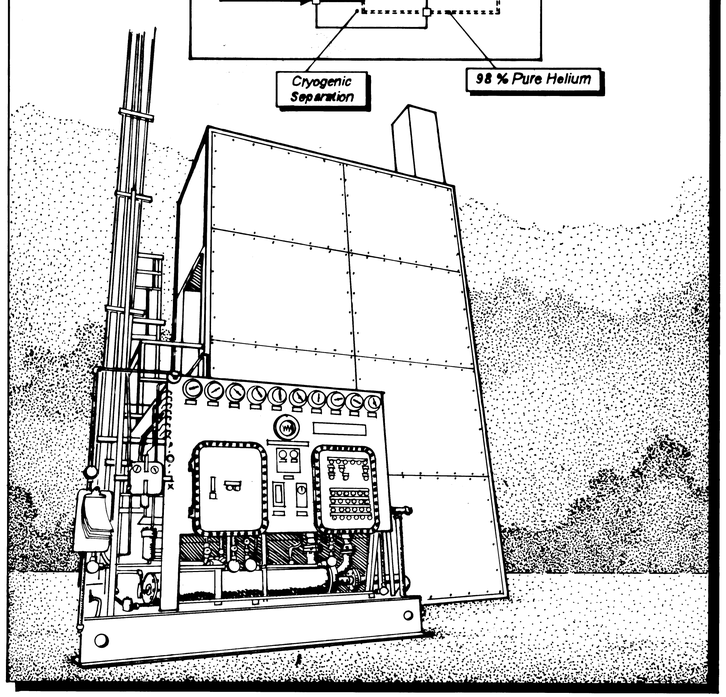


99.995 Percent Pure Helium — 1946-1979

After WW II, the demand for helium declined. Clifford W. Seibel, in an effort to salvage the federal helium program, sought to expand markets and accelerate research for new uses of helium. The results were many new innovations such as heliarc welding, although they required a purer grade of helium. The refrigerated activated charcoal process, experimented with in the 1920's, was refined. In 1949, Exell brought a new, improved purifier on line in order to satisfy market requirements for 99.995 percent purity.

First, scientists cryogenically purified crude helium to 98 percent purity using the traditional method. Next, they would pass the purified helium through double charcoal purification to eliminate most of the nitrogen and neon. The charcoal purifier consisted of three vessels arranged so that two of the vessels were constantly in operation while the third vessel was being regenerated. After this charcoal filtration process, the gas reached 99.995 percent pure helium.

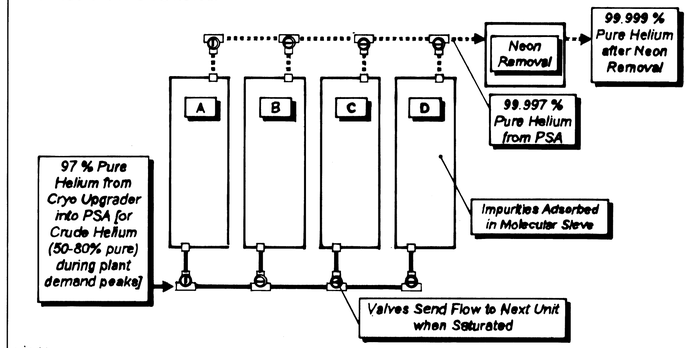


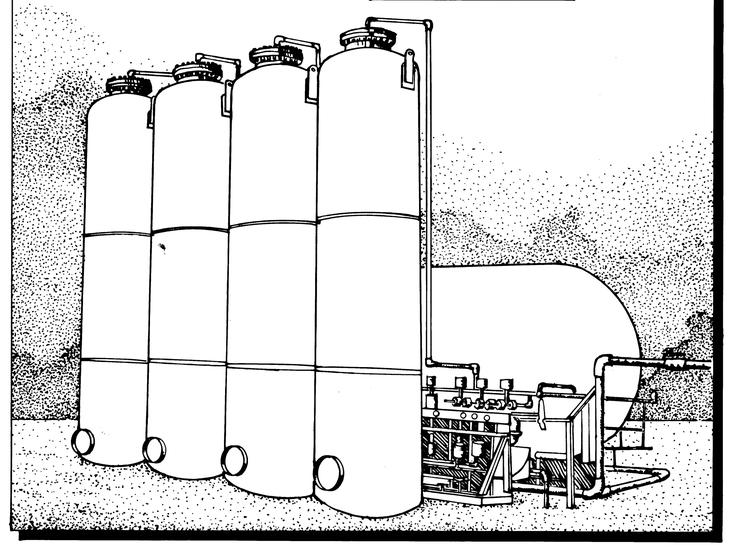


99.999 Percent Pure Helium — 1980-1998

In 1980, Exell witnessed an advance in technology when the Pressure Swing Adsorption Unit was developed and installed by the Hudson Engineering Company. This was the plant's first non-cryogenic purifier, which used pressure and molecular exchange to produce 99.997 percent helium. This step was later followed by a neon removal process that resulted in 99.999 percent pure helium.

Under normal operating conditions, gas came into the PSA from the cryogenic purifier which was used to upgrade the gas to 97 percent purity, thus increasing the PSA's efficiency. However, during demand peaks, the cryogenic purifier ran in parallel with the PSA, and both units produced crude helium. In the PSA, impure atoms in the gas clung to the outer surfaces of the molecular sieve. Helium, hydrogen, and neon, however, did not cling to the sieve. Deoxo processing eliminated the hydrogen, before the PSA while the neon removal unit extracted the neon, after the PSA resulting in pure helium. The PSA consisted of four units (A,B,C,&D). One unit operated until its molecular sieve was 80% saturated with impurities, at which point the gas flow would transfer to the next unit. The saturated units in turn were cleansed through depressurization and a series of reverse flows.





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HELIUM ACTIVITIES RECORDING PROJECT

NATIONAL PARK SERVICE
UNITED STATES DEPARTMENT OF THE INTERIOR

U.S. BUREAU OF MINES, HELIUM PLANTS, EXELL HELIUM PLANT 1943

HIGHWAY 287 N.
MOORE COUNTY, TEXAS

MASTERSON

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HISTORIC AMERICAN ENGINEERING RECORD TX-105 B

HISTORIC AMERICAN ENGINEERING RECORD, NATIONAL PARK SERVICE. NAME OF DELINEATOR, DATE OF THE DRAWING

TRIM LINE

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